Chapter 5:

How Far? How Tall? How Steep?

Section 5.1 - Ratios Based on Right Triangles

Curriculum Outcomes	Related Activities	Page in Text
• use inductive and deductive reasoning when observing patterns, developing properties, and making conjectures	• use nested triangles to see that the effect of a dilatation from a vertex of a triangle is to create similar triangles • measure side lengths in similar triangles to observe constant ratios and generalize from the patterns	213 213
• determine whether differenced in measurement, while conducting experiments are significant or crucial	• compare ratios based on measurements which might be close to equal, ut not exactly equal, to decide if equality can be assumed	214
• determine and apply formulas for perimeter, area, surface area, and volume	• examine the effect of scale factors on triangle perimeter and area	215
• solve problems involving similar triangles and right triangles	• find missing lengths in triangles by setting up proportions with similar triangles	215
• solve problems involving measurement using bearings and vectors • apply the properties of similar triangles	• explore the equivalence of vector, compass direction, and bearing descriptions of movement	216

5.1 – Ratios Based on Right Triangles

Congruent Triangles

- Two triangles are congruent if all the angles and all the side lengths of one triangle match all the angles and all the corresponding side lengths of the other. It looks as if the first triangle had been moved to a new spot.

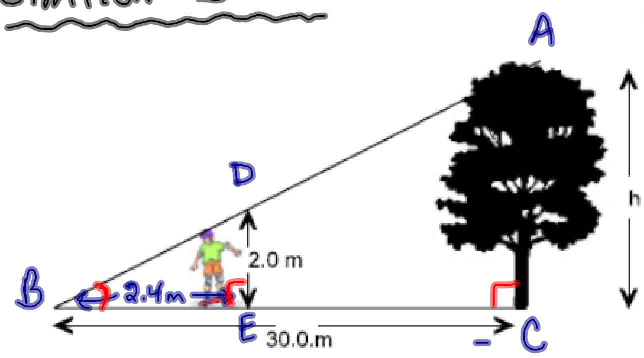
5.1 – Ratios Based on Right Triangles

<u>Similar Triangles</u>

- Two triangles are similar if one triangle is an enlargement or reduction of the other. The triangles have exactly the same angles, but each of the side lengths of one triangle is the same multiple (could be a decimal number such as 1.5) of the corresponding side length of the other.

Similar Δ Ex:

All angles in a triangle add up to 180°.



Ratios:

$$\frac{AB}{DB} = \frac{CB}{EB} = \frac{AC}{DE}$$

1. Re-draw and label the diagram above, using similar triangles.

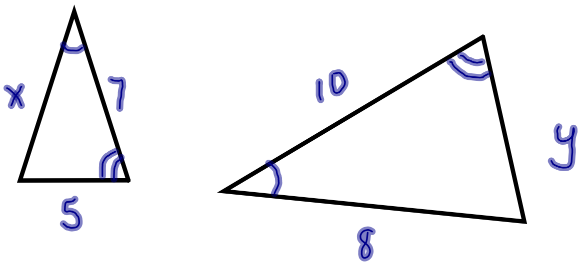
2. Determine the height of the tree.

$$2.\ \frac{30.0}{2.4} = \frac{h}{\cancel{2.0}} \cdot \cancel{2}$$

$$\frac{60}{2.4} = h$$

$$h = 25m$$

Ex. #2:



$$\frac{10}{7} = \frac{8}{x} = \frac{y}{5}$$

$$\cancel{5} \cdot \frac{y}{\cancel{5}} = \frac{10}{7} \cdot 5$$

$$y = \frac{50}{7}$$

$$y = 7.1$$

$$\cancel{x} \cdot \frac{8}{\cancel{x}} = \frac{10}{7} \cdot x$$

$$7 \cdot 8 = \frac{10x}{\cancel{7}} \cdot \cancel{7}$$

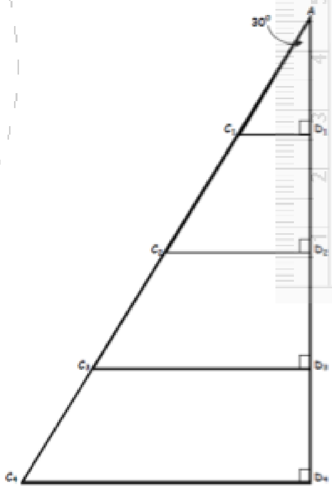
$$\frac{56}{10} = \frac{\cancel{10}x}{\cancel{10}}$$

$$x = 5.6$$

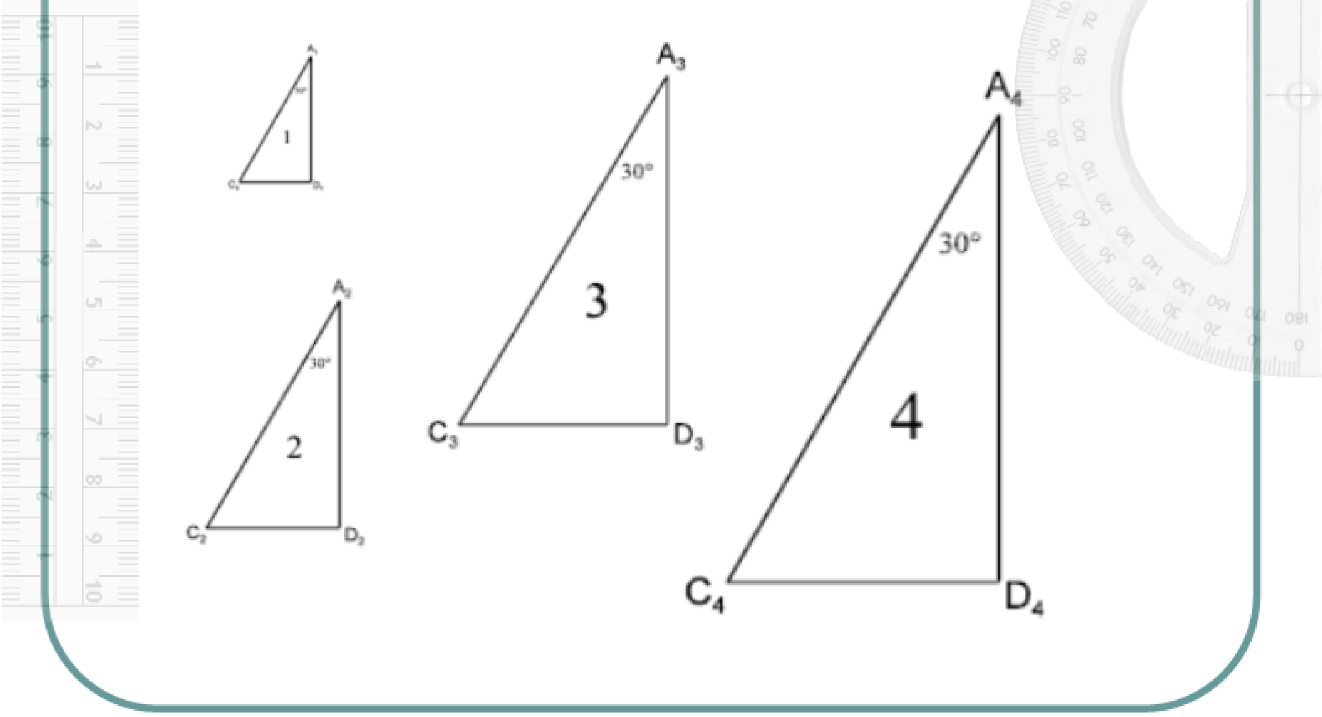
$$\frac{8}{x} = \frac{10}{7}$$

$$56 = 10x$$

Investigation 1



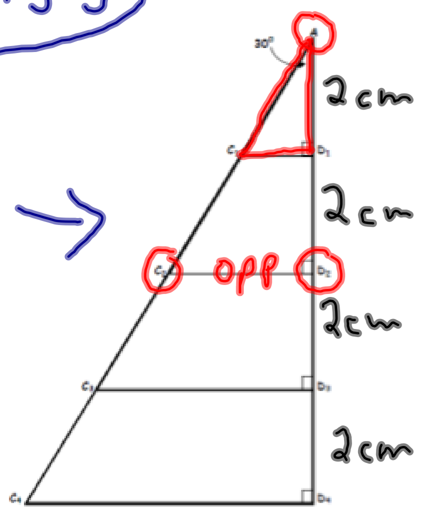
Investigation 1

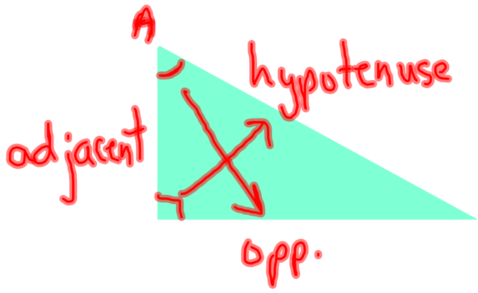


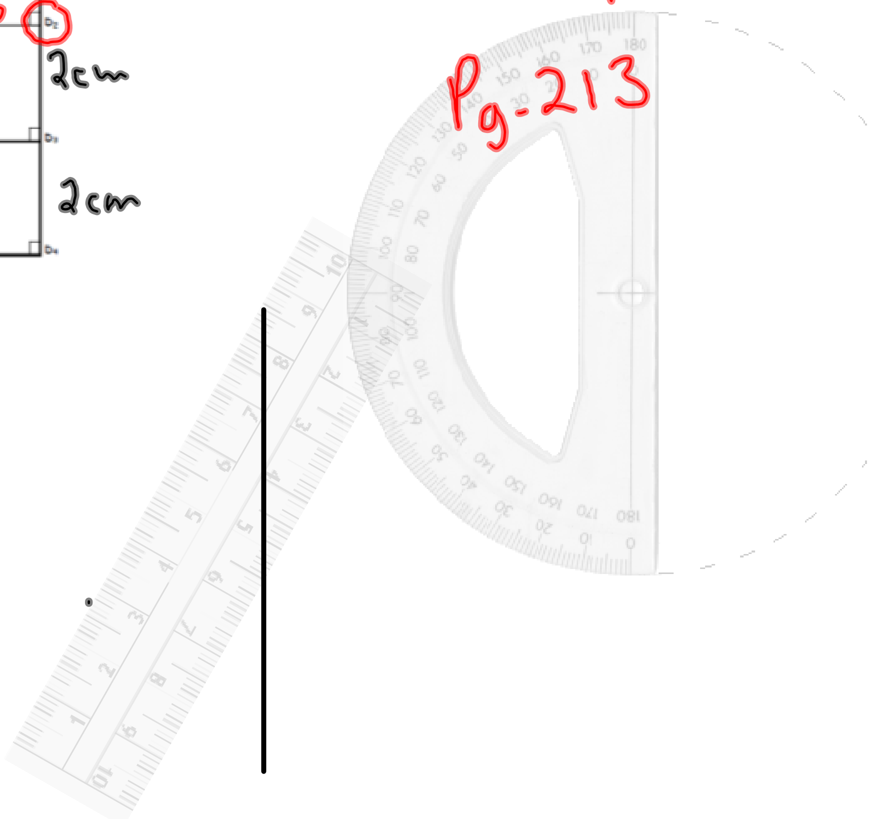
	ACTUAL MEASUREMENT			Ratios		
Triangle Number	Opposite to ∠A CD	Adjacent to ∠A AD	Hypotenuse AC	$\frac{\text{Opposite}}{\text{Hypotenuse}}$	$\frac{\text{Adjacent}}{\text{Hypotenuse}}$	$\frac{\text{Opposite}}{\text{Adjacent}}$
1	1.2	2.0	2.3			
2						
3						
4						

C: What do you notice about the ratios you formed in the last three columns of the tables?

Pg.214 #3-5







Solve the following proportions.

a) $\frac{x}{3} = \frac{10}{5}$ b) $\frac{7}{x} = \frac{2}{3}$ c) $\frac{3}{4} = \frac{x}{8}$ d) $\frac{6}{5} = \frac{8}{y}$

e) $\frac{4}{5} = \frac{12}{z}$ f) $\frac{9}{2} = \frac{x}{4}$ g) $\frac{x}{15} = \frac{3}{5}$ h) $\frac{5}{1} = \frac{x}{3}$

<u>Classwork/Homework</u>

- FMT (yellow text)
  Pg.319 Exercise 2

#7 4. $\frac{10}{6} = \frac{x}{\cancel{4}} \cdot \cancel{4}$

$\frac{40}{6} = x$

$x = 6.7$

#8 7. $\frac{11}{8} = \frac{7+x}{\cancel{7}} \cdot \cancel{7}$

$\frac{77}{8} = 7 + x$

$9.6 = \cancel{7} + x$
$-7 \quad -\cancel{7}$

$x = 2.6$

#9 3. $\frac{7}{5} = \frac{y}{\cancel{3}} \cdot \cancel{3}$

$\frac{21}{5} = y$

$y = 4.1$

Check Your Understanding

- Page 214 # 6-11

#6a) $\Delta AB_2C_2 \sim \Delta AB_1C_1$

- they share $\angle A$
- they both have right angles ($\angle B_2 = \angle B_1$)

b) $\frac{AB_2}{AB_1} = \frac{AC_2}{AC_1} = \frac{B_2C_2}{B_1C_1}$ $\cancel{24} \cdot \frac{x}{\cancel{24.0}} = \frac{20.0}{10.0} \cdot 24$

$\frac{x}{24.0} = \frac{52.0}{y} = \frac{20.0}{10.0}$ $x = 48$

c) $\frac{52.0}{y} = \frac{20.0}{10.0}$

$\frac{520.0}{20} = \frac{20.0y}{20}$

$y = 26.0$

#7. a) Yes, they are all similar
Because each length increased by the same factor.

b) Area = $\frac{b \cdot h}{2}$ Perimeter = add up all sides.

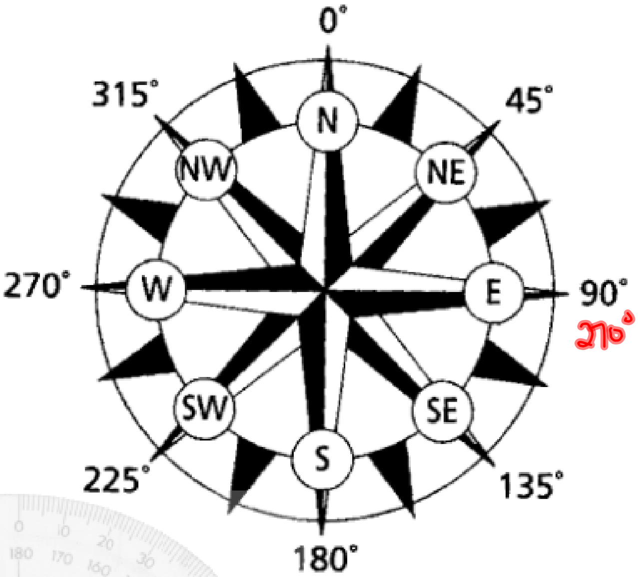
#9, #10

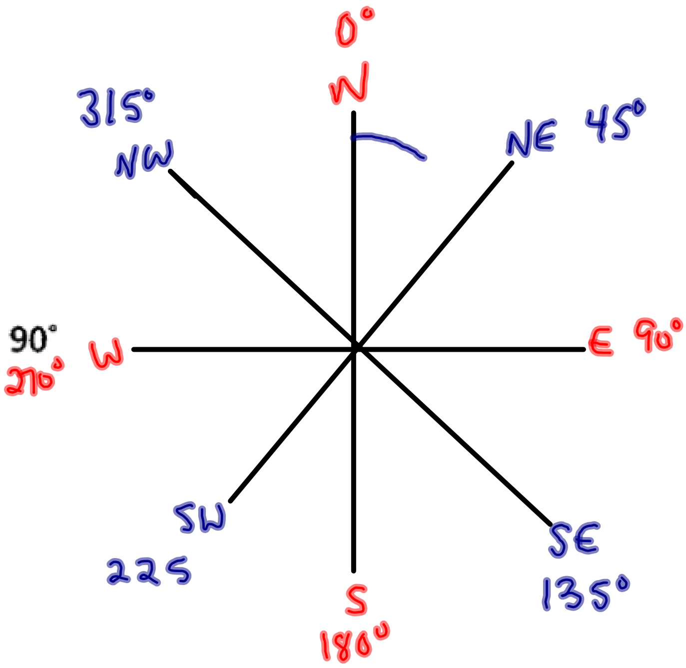
→ Make table on Pg. 214 ←

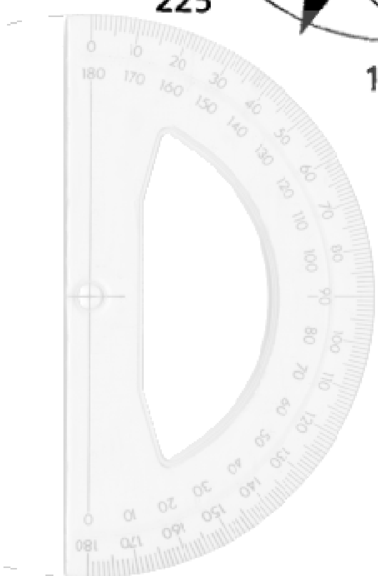
Focus C – Vectors and Bearings

Bearing: the direction using an angle measured clockwise from north

- An easterly direction is read as 90 degrees
- A westerly direction is 270 degrees.
- See page 217 for examples


0°
315°
45°
N
NW
NE
270°
W
E
90°
SW
SE
S
225°
135°
180°


0°
N
315°
NW
NE 45°
270° W
E 90°
SW
225
S
180°
SE
135°



Focus C – Vectors and Bearings

<u>Vectors</u>

- drawn as arrows
- Each shows a distance and a direction
- A scale is needed when vectors are drawn
- See page 217 for an example

Focus C – Vectors and Bearings

Example:

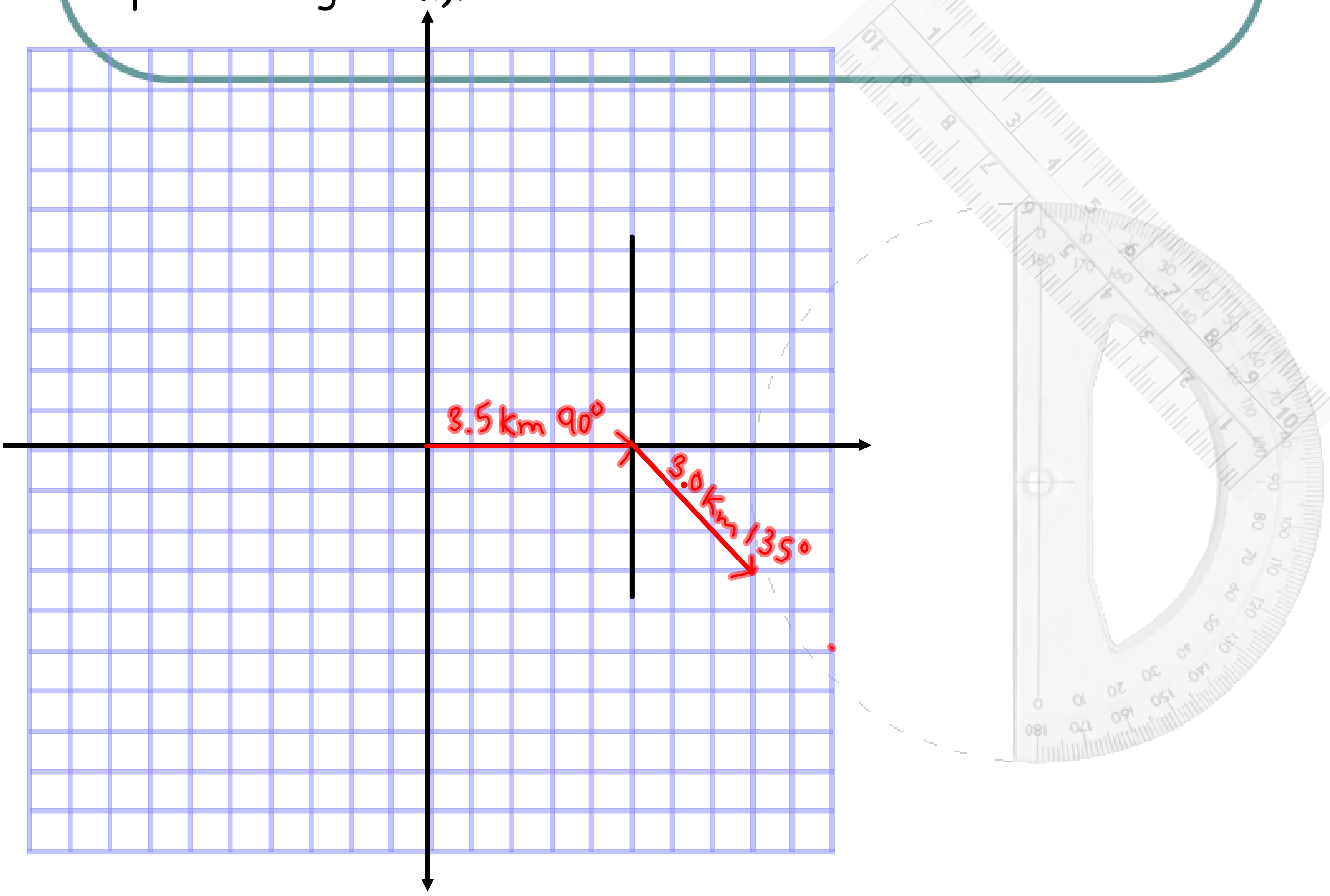
Jill is walking 4.5 km/h on her way home from school. She took the measurements of her walk home; they are as follows:

-First, a bearing of 90° for 3.5km

-Then a bearing of 135° for 3km

Question #1

Draw a scale diagram of the above (use a scale of 1 cm representing 1 km).



Focus C – Vectors and Bearings

Example:

Jill is walking 4.5 km/h on her way home from school. She took the measurements of her walk home; they are as follows:

-First, a bearing of 90 for 3.5km

-Then a bearing of 135 for 3km

Question #2:

Calculate how much time it would take for her to complete each section of her trip home. What is the total time required?

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Rearrange for Time.......

$$T \cdot S = \frac{D}{\cancel{T}} \cdot \cancel{T}$$

$$\frac{T \cancel{S}}{\cancel{S}} = \frac{D}{S} \qquad T = \frac{D}{S}$$

Speed = 4.5 km/hr.

$$\text{Time}_1 = \frac{\text{Distance}}{\text{Speed}} = \frac{3.5}{4.5}$$

$$\text{Time}_1 = 0.78 \text{ hr}$$

$$\text{Time}_2 = \frac{3.0}{4.5} = 0.67 \text{ hr}$$

Total = 0.78 + 0.67 = 1.45 hr.

1hr. 27mins

$$60 \cdot \frac{45}{100} = \frac{x}{\cancel{60}} \cdot \cancel{60}$$

$$x = \frac{2700}{100} = 27 \text{ mins.}$$

Focus C – Vectors and Bearings

Example:

Jill is walking 4.5 km/h on her way home from school. She took the measurements of her walk home; they are as follows:

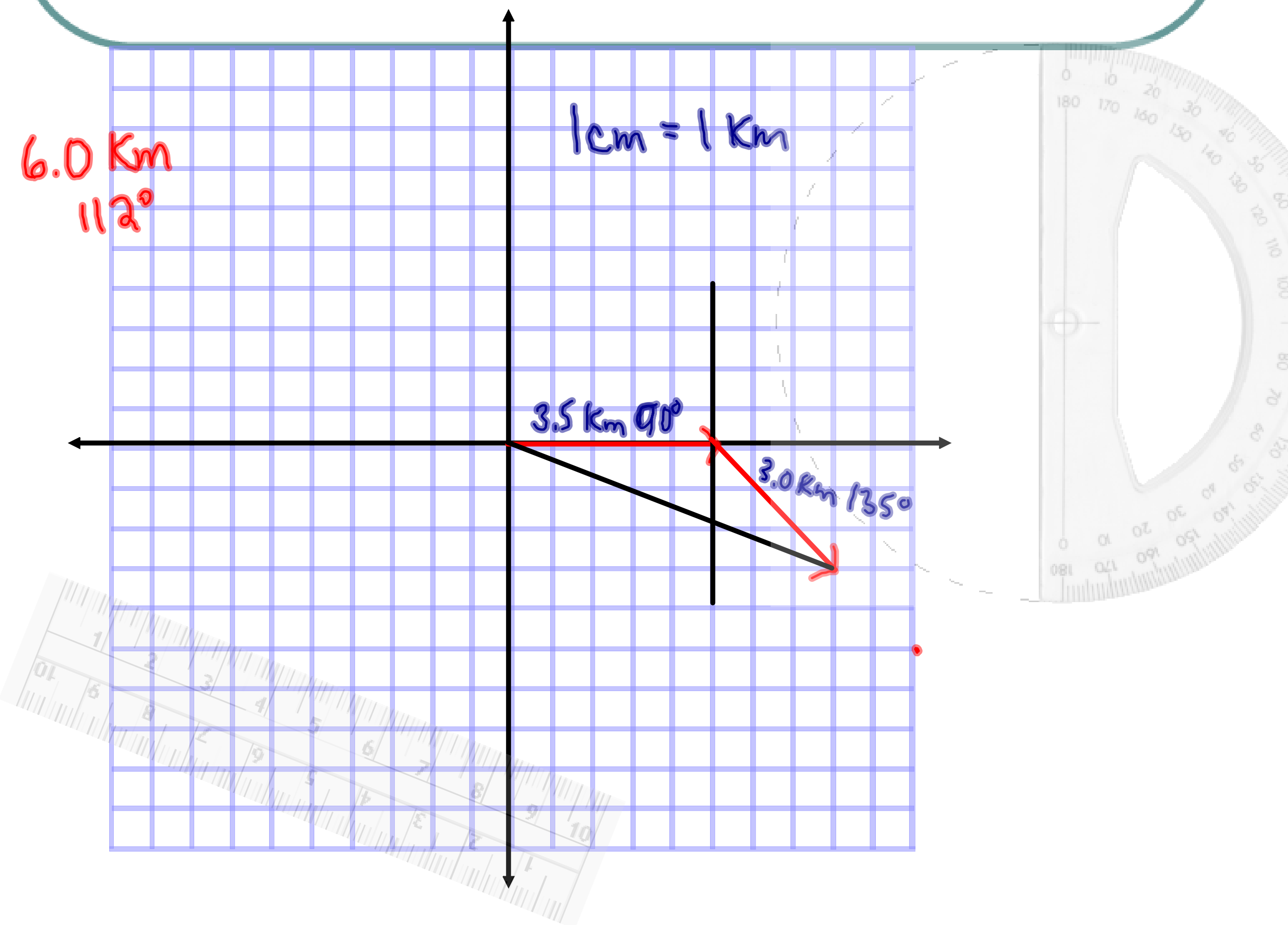
-First, a bearing of 90 for 3.5km

-Then a bearing of 135 for 3km

Question #3:

Figure out where she ends up. (give the bearing of her house from where she started).

Draw this vector on your diagram.



Focus C – Vectors and Bearings

Example:

Jill is walking 4.5 km/h on her way home from school. She took the measurements of her walk home; they are as follows:

-First, a bearing of 90 for 3.5km

-Then a bearing of 135 for 3km

Question #4:

How far apart are the start and finish locations?

Write a set of instructions that would get Jill there more quickly.

Travel 6.0 km 112° from North.

Focus C – Vectors and Bearings

Example:

Jill is walking 4.5 km/h on her way home from school. She took the measurements of her walk home; they are as follows:

-First, a bearing of 90 for 3.5km

-Then a bearing of 135 for 3km

Question #5:

How much time would it take to go the shorter way?

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Time} = \frac{6.0}{4.5} = 1.33 \text{ hr.} \qquad 1 \text{ hr. } 20 \text{ mins.}$$

$$\left\{ \frac{33}{100} = \frac{x}{60} \qquad x = 20 \right\}$$

Focus C – Vectors and Bearings

- Check Your Understanding
- Page 217-218 #12-16

12. a) 6 km South
6 km at a bearing of 180°